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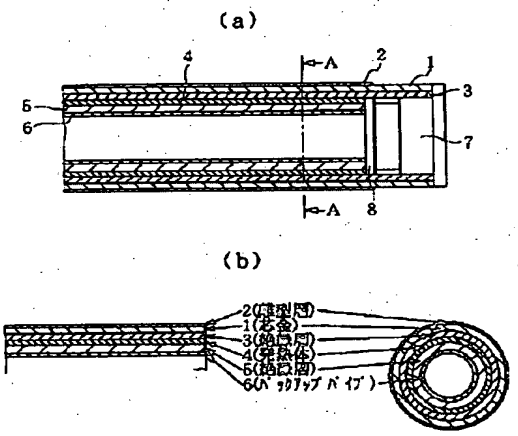
KENJO KOSHIN

(54) HEATING TYPE FIXING ROLLER

(57) Abstract:

PROBLEM TO BE SOLVED: To prevent the swelling phenomenon of an insulating layer and a heating element from occurring by combining a thin structure body whose heat capacity is small, to prevent the temperature of the heating element from abnormally rising and to prevent the durability of the insulating layer from being lowered by enabling heat to be transmitted to the structure body even when the heating element is peeled by any chance.

SOLUTION: This heating type fixing roller is provided with a cylindrical core bar 1, the insulating layer 3 laminated at the inside surface of the core bar 1 and the heating element 4 laminated at the inside surface of the layer 3. Then, a metallic foil pipe 6 whose thermal expansion coefficient is larger than that of the core bar is inserted in the inside surface of the heating element through another insulating layer.



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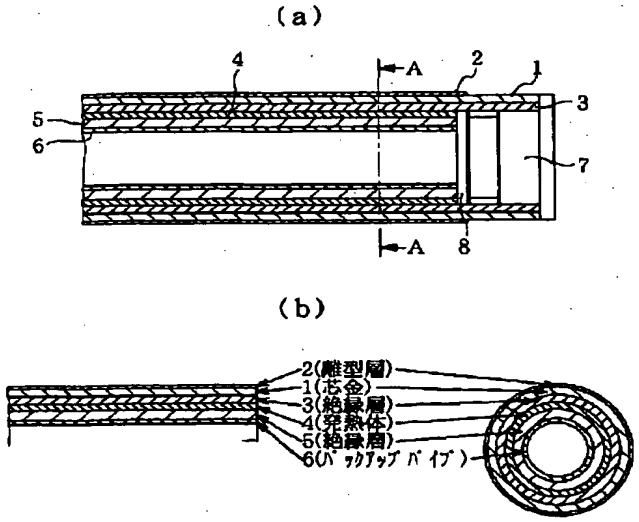
(54)【発明の名称】　発熱型定着ローラ

(57)【要約】
【課題】　薄肉で熱容量が小さい構造体を組み合わせることにより、絶縁層及び発熱体の膨れ現象を防止するとともに、万が一、発熱体が剥がれた場合でも熱がその構造体の方に伝わるようにし、発熱体が異常昇温するのを防ぎ、絶縁層の耐久性が低下することを防止できるようにする。
【解決手段】　円筒状の芯金１と、該芯金内面に積層した絶縁層３と、該絶縁層の内面に積層した発熱体４と、を備えた発熱型定着ローラにおいて、発熱体の内面に、他の絶縁層を介して前記芯金よりも熱膨張率の大きい金属箔肉パイプ６を挿入した。



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【特許請求の範囲】

【請求項１】　円筒状の芯金と、該芯金内面に積層した絶縁層と、該絶縁層の内面に積層した発熱体と、を備えた発熱型定着ローラにおいて、
前記発熱体の内面に、他の絶縁層を介して前記芯金よりも熱膨張率の大きい金属箔肉パイプを挿入したことを特徴とする発熱型定着ローラ。

【請求項２】　円筒状の芯金と、該芯金内面に積層した絶縁層と、該絶縁層の内面に積層した発熱体と、を備えた発熱型定着ローラにおいて、
前記発熱体の内面に絶縁性と耐熱性を有した樹脂製箔肉パイプを挿入したことを特徴とする発熱型定着ローラ。

【請求項３】　円筒状の芯金と、該芯金内面に積層した絶縁層と、該絶縁層の内面に積層した発熱体と、を備えた発熱型定着ローラにおいて、
前記発熱体の内面に、必要に応じて他の絶縁層を介して熱膨張率の異なる複数の材料を積層したＣ形断面形状を有する箔肉パイプを挿入固定したことを特徴とする発熱型定着ローラ。

【請求項４】　円筒状の芯金と、該芯金内面に積層した絶縁層と、該絶縁層の内面に積層した発熱体と、を備えた発熱型定着ローラにおいて、
前記発熱体の内面に、必要に応じて他の絶縁層を介してバネ性のある材料から成るＣ形断面形状を有する箔肉パイプを挿入固定したことを特徴とする発熱型定着ローラ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、電子写真プロセスを利用した画像形成装置の定着装置に用いられる発熱型定着ローラの改良に関し、特に芯金内面に固定した発熱体に通電することにより発生した熱により芯金を加熱するようにしたタイプの発熱型定着ローラに関する。

【０００２】

【従来の技術】電子写真プロセスを利用した画像形成装置は、感光体上に形成したトナー像を転写紙上に転写してから、該転写紙を定着装置内に備わった定着ローラ（加熱ローラ）と加圧ローラとの間を通過させることにより、熱と圧力によってトナー像を転写紙上に定着させている。複写機等の電子写真式画像形成装置に対する省エネルギー化の要請が高まるにつれて、消費電力の大きい従来のハロゲンヒータを用いた定着ローラに代えて、立ち上がり時間の短い加熱型の定着ローラの開発が各社で行われている。これは複写機が消費する電力のほとんどが待機時の定着ローラの発熱により消費されており、この発熱のための電力消費を皆無にするか、或は減少させることが可能であるならば、かなりの消費電力の低減につながるからである。芯金の中空内部にハロゲンヒータを配置して芯金を加熱するようにした旧来の定着ローラに代えて、比較的新しいタイプの定着ローラとして、

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芯金の内面に絶縁層を介して発熱体を一体形成した発熱型の定着ローラが用いられている。

【０００３】図４は上記発熱型の定着ローラの一例の構成を示す縦断面図、図５(a) 及び(b) は各構成要素の分解図及び断面図であり、この定着ローラは、鉄等の芯金２１と、その表面に形成された離型層２２と、芯金２１の内面に積層一体化した絶縁層２３と、絶縁層２３の内側に積層一体化した蛇行形状（櫛歯形状）の発熱体（発熱シート）２４と、を有する。符号２５は発熱体２４の軸方向両端部に配置した給電用の電極である。絶縁層２３としてはマイカやポリイミド、発熱体２４としてはＳＵＳ箔（５０μｍ）を用い、これらを耐熱接着剤を用いて芯金２１の内面に貼り付けたタイプの発熱型の定着ローラが知られている。しかしこのタイプの定着ローラはその開発段階で以下のような問題が発生している。即ち、絶縁層２３をマイカやポリイミドにて構成しているのにも関わらず、湿度９０％、温度４０℃の環境下で２４時間放置後通電すると、絶縁層２３や接着剤に吸湿した水分が水蒸気となって蒸発し、絶縁層を膨らませる現象（膨れ）が発生する。この実験は、条件的には極端ではあるが、梅雨時などの湿気の多い状態で放置することもある程度考えておくことが必要なためこのような試験が行われる。絶縁層２３にこのような膨れ現象が発達すると、接着されている発熱体２４が剥がれ易くなる。発熱体２４が剥がれると、定着ローラの芯金部部の温度がトナーを定着させるのに必要な所望の温度まで上昇せず、本部品の機能を満足しなくなる。また更には発熱体２４が剥離した部分からは熱が芯金に伝わらないために、局部的に加熱されることとなり、定着性能にバラツキが発生する。このように極端な場合を想定するまでもなく、芯金内面と絶縁層の接着が不均一で、接着が不十分な場合、或は経時的にそのような接着不良に陥った場合には、ヒートサイクルを繰り返すと、絶縁層の膨れや剥れが発生して、発熱体からの熱が芯金２１に均一に伝達しないという不具合が発生して画像品質への影響が発生し、更に発熱体の熱が芯金に伝わらずに蓄熱し、絶縁層の耐熱温度を越えてしまうという問題が生じる。この問題を解決する一つの方法が、絶縁層が膨れないないように内側から押さえることである。バンドー化学製の発熱ローラなどはこの方法を採用しており、発熱体の内側にスポンジのシリコンゴムを挿入し、加熱時にそれが膨張し発熱体を内側から押さえつける働きをしている。しかしこの低ローラにあっては、スポンジのシリコンゴムの熱容量が大きいため、ゴム側に熱の多くが奪われ、本来このローラが目標にしている立ち上がり時間の短縮と言う課題が達成できなくなる。

【０００４】

【発明が解決しようとする課題】本発明は上記に鑑みてなされたものであり、薄肉で熱容量が小さい構造体を組み合わせることにより、絶縁層及び発熱体の膨れ現象を

防止するとともに、万が一、発熱体が剥がれた場合でも熱がその構造体の方に伝わるようにし、発熱体が異常昇温するのを防ぎ、絶縁層の耐久性が低下することを防止できるようにすることを目的としている。

【０００５】

【課題を解決するための手段】上記課題を達成する為、請求項１の発明は、円筒状の芯金と、該芯金内面に積層した絶縁層と、該絶縁層の内面に積層した発熱体と、を備えた発熱型定着ローラにおいて、前記発熱体の内面に、他の絶縁層を介して前記芯金よりも熱膨張率の大きい金属箔肉パイプを挿入したことを特徴とする。請求項２の発明は、円筒状の芯金と、該芯金内面に積層した絶縁層と、該絶縁層の内面に積層した発熱体と、を備えた発熱型定着ローラにおいて、前記発熱体の内面に絶縁性と耐熱性を有した樹脂製箔肉パイプを挿入したことを特徴とする。請求項３の発明は、円筒状の芯金と、該芯金内面に積層した絶縁層と、該絶縁層の内面に積層した発熱体と、を備えた発熱型定着ローラにおいて、前記発熱体の内面に、必要に応じて他の絶縁層を介して熱膨張率の異なる複数の材料を積層したＣ形断面形状を有する箔肉パイプを挿入固定したことを特徴とする。請求項４の発明は、円筒状の芯金と、該芯金内面に積層した絶縁層と、該絶縁層の内面に積層した発熱体と、を備えた発熱型定着ローラにおいて、前記発熱体の内面に、必要に応じて他の絶縁層を介してバネ性のある材料から成るＣ形断面形状を有する箔肉パイプを挿入固定したことを特徴とする。

【０００６】

【発明の実施の形態】以下、本発明に係る発熱型定着ローラを図面に示した実施の形態により詳細に説明する。図１(a) 及び(b) は本発明に係る発熱型定着ローラの構成を示す縦断面図、及びＡ－Ａ断面図等を示す図である。定着ローラの芯金１は、剛性があり、熱膨張率が小さく、安価な鉄等の材料が好ましく、錆を防止するためにパーカ処理を施しておく必要がある。またこの芯金１の胴部外面にはテフロン系（ＰＦＡやＰＴＦＥ）の離型層２が形成されている。芯金１の内面には第１の絶縁層３が積層形成されており、材質は絶縁性と耐熱性を考慮したマイカや耐熱性のポリイミドの単層や両方を張り合わせた物、もしくはガラス繊維を裏打ちした物などを用いる。この絶縁層３と芯金内面は接着してもしなくてもいずれであってもよい。さらに絶縁層３の内側面には発熱体４が耐熱性の接着剤により接着されている。発熱体４はＳＵＳ等の金属箔（厚さ５０μｍ程度）を、エッチングやレーザ加工などの方法によって所望の抵抗値が得られるように任意のパターンにカッティングしたものである（図５(a) 参照）。発熱体４の接着に使用する接着剤としてはシリコーン系やイミド系の耐熱性のある接着剤が望ましい。発熱体４の内側面には更に第２の絶縁層５が形成されている。その材質は第１の絶縁層３に用いたものと同じ材質でかまわない。この絶縁層５は、前記と同じ耐熱性のある接着剤で発熱体４の内面に接着する。

【０００７】本実施形態では、このような構成の発熱型定着ローラ内にもう一つバックアップ用のパイプ６を挿入する。このバックアップパイプ（箔肉パイプ）６の材質は例えばアルミニウム系材料から成る箔肉（厚み０．５ｍｍ以下）のように定着ローラの芯金よりも熱膨張率の大きな金属を薄肉円筒に加工して用いることが望ましい。バックアップパイプ６はその両端部に給電用の電極７が挿入されるため定着ローラの芯金１よりもその全長が短くなっており、電極７に接触しないようにバックアップパイプ６と電極７の間には絶縁リング８が介在する。この絶縁リング８は耐熱性のある樹脂で製作するのが望ましくＰＴＦＥなどがそれに当たる。このように本実施形態では、鉄系材料から成る芯金１内に順次貼られた絶縁層３及び発熱体４を保持するためのバックアップパイプ６として、芯金１よりも熱膨張の大きい材質（アルミ系材料等）から成る金属製箔肉パイプ６を使用する。本実施形態の定着ローラに給電すると、発熱体４が発熱して芯金１及び内側のバックアップパイプ６に熱が伝わる。バックアップパイプ６は熱膨張により外径方向へ拡開して、絶縁層３及び発熱体４を芯金１の内面に押し付ける。このため、絶縁層３や発熱体４の膨らみや剥離が防止され、発熱体からの熱が芯金１に均一に伝達しないことによる画像品質への影響や、発熱体の熱が芯金に伝わらずに蓄熱し、絶縁層の耐熱温度を越えて部品交換が必要になるという不具合を防止できる。

【０００８】次に図１の実施形態に係る発熱型定着ローラの動作、原理を更に詳細に説明する。まず、図１に示した発熱型定着ローラの発熱体４に通電して発熱すると、その熱が芯金１はもちろんバックアップパイプ６にも伝わることになる。芯金１よりバックアップパイプ６の方が熱膨張率が大きいのでバックアップパイプ６は芯金１を内面から外径方向へ押しつける方向に作用する。これにより２つのパイプ形状の部材１、６が焼きバメの原理で一体化することになり、芯金１やバックアップパイプ６の単体での強度が足りなくとも定着ローラ全体としての剛性を得ることが可能となる。また、定着ローラ全体の熱容量は、バックアップパイプ６が無い場合の定着ローラと比較しても、それほど大きくはならないので定着ローラの立ち上がり時間として見たときには、大きな差は生じない。また通電による加熱時にはバックアップパイプ６が定着ローラの芯金１の内面を外径方向へ押圧する方向に力が働くので、絶縁層３が浮いて芯金内面から離れ発熱体４を剥がすことにより発熱体４が異常昇温し絶縁層３の耐久性が低下する不具合を防止できる。また絶縁層３が浮き、万が一発熱体４が剥がれた場合でも、発熱体４は第２の絶縁層５を介してバックアップパイプ６に接触しているので、発熱体４にて発生した熱は

定着ローラの芯金１には伝わらない一方で、バックアップパイプ６に伝わって逃げるので、発熱体４が異常昇温することは無く、絶縁層３や絶縁層５の耐久性が低下することはない。但し、この場合、発熱体４が芯金１から剥離した部分に関しては定着ローラの芯金１に発熱体４の熱が伝わらないのでローラ自体は所望の温度に達しないためトナーを定着することができない。従ってその現象が起こった時点でサービスパーツと交換することが必要となる。

【０００９】次に、図２(a) 及び(b) は第２の実施形態に係る発熱型定着ローラの縦断面図、及びＢ－Ｂ断面図等を示し、定着ローラの芯金１～発熱体４までの構成と電極７の構成は図１の場合と同じであるため、重複した構成の説明は省略する。この実施形態が図１の実施形態と異なるのは、第２の絶縁層５を用いずに、絶縁性と耐熱性を有したバックアップパイプとしてのＰＴＦＥ製箔肉パイプ９を直接発熱体４の内面に取り付けた点である。バックアップパイプを構成するＰＴＦＥは芯金１を構成する金属材料（鉄やアルミ）よりも熱膨張率が大きいので、図１の場合と同じ抑え込み機能を、より簡略化した構造で達成することが可能となる。本例では、芯金は鉄系材料で、バックアップパイプ９には鉄より熱膨張の大きいＰＴＦＥを用いたが、ＰＴＦＥは一例であり、上記条件を満たす絶縁、耐熱材料であれば、何を使用してもよい。このようにこの実施形態では、芯金１内に貼られた絶縁層３及び発熱体４を保持して膨れや剥離を防止するために、芯金１を構成する材料よりも熱膨張の大きい絶縁物から成るバックアップパイプ９を使用したので、発熱体４とバックアプパイプ９を絶縁するための第２の絶縁層５や、バックアップパイプと給電電極間に介在する絶縁リング８が不要となる。本実施形態の定着ローラに給電すると、発熱体４が発熱して芯金１及び内側のバックアップパイプ６に熱が伝わり、バックアップパイプ６を熱膨張により外径方向へ拡開させるので、絶縁層及び発熱体を芯金内面に押し付ける。このため、絶縁層３や発熱体４の膨らみや剥離が防止され、発熱体からの熱が芯金１に均一に伝達しないことによる画像品質への影響や、発熱体の熱が芯金に伝わらずに蓄熱し、絶縁層の耐熱温度を越えて部品交換に至るという不具合を防止することができる。

【００１０】次に図３(a) 及び(b) は第３の実施形態に係る発熱型定着ローラの縦断面図、及びＣ－Ｃ断面図等であり、(c) はバックアップパイプの一例の斜視図である。なお、定着ローラの芯金１～絶縁層５までの構成と、電極７、絶縁リング８の構成は図１の場合と同じである。本実施形態が図１の場合と異なるのはバックアップパイプの部分の構成である。図３の実施形態では連続した円筒状のバックアップパイプ６の代わりに、バックアップパイプとして合わせ材（異種金属を重ね合わせ完全に結合させた層状の複合合金板、例えばバイメタルなどに用いられる板材）をＣ型断面になるように曲げ加工したＣ型補強パイプ１０を用いた点が特徴的である。合わせ材を用いたＣ型補強パイプ１０は線膨張率の異なる金属１０Ａ、１０Ｂを貼り合わせた２層構造になっている。Ｃ形状の内側に線膨張率の大きな金属１０Ａが、外側にそれよりも線膨張率の小さな金属１０Ｂが積層一体化されるように２種の金属を貼り合わせ結合する。これらの合わせ材の材質としては、外側に位置する低膨張率の合金は例えばインバー（Ｎｉ－Ｆｅ）など、内側に位置する高膨張率の合金としてはオーステナイト系のＮｉ－Ｃｒ・Ｆｅ合金、Ｎｉ－Ｍｎ－Ｆｅ合金などを例示できる。このように第３の実施形態では、芯金１内に貼られた絶縁層３及び発熱体４を保持するのに、合わせ材料をＣ型断面（円筒体の一部を軸方向全長に亙って切断した形状）になるように曲げ加工したＣ型バックアップパイプ１０を使用する。Ｃ型バックアップパイプ１０は線膨張率の異なる金属を貼り合わせた２層構造になっており、加熱によって外径方向へ拡開する。更に、筒体の形状自体がＣ形状であるため、バックアップパイプの挿入時に径を縮めておいて容易に挿入位置決めした後で、縮径方向への加圧を解除することにより拡開させてローラ内部に取り付けることができる。そのため、前記各実施形態にて使用するバックアップパイプよりも径の大きいものを使用することができる。なお、バックアップパイプ１０が金属製であるため、第１の実施形態と同様に発熱体４とバックアップパイプ１０を絶縁するための絶縁層５と、バックアップパイプと給電電極７間を絶縁するための絶縁リング８を挿入する。

【００１１】次いで、図３に示した第３の実施形態についてその動作、原理を説明する。即ち、図３の構成を備えた発熱型定着ローラの発熱体４に通電して発熱させると、その熱が芯金１は勿論、Ｃ型補強パイプ１０にも伝わることになる。Ｃ型補強パイプは線膨張差のある２つの金属（箔）１０Ａ、１０Ｂを結合させた合わせ材であり、更にＣ型形状の内側にある金属１０Ａの線膨張率が外側にある金属１０Ｂの線膨張係数よりも大きい為に、このＣ型を外径方向に拡開させる方向へ力が働く為、図１の場合と同様に、定着ローラの芯金１には内面から外側へ押す方向に力が作用することとなる。従って、絶縁層３が芯金内面から浮きを起こして剥離し、発熱体４を剥すことにより、発熱体が異常昇温して絶縁層３の耐熱温度を越える事態の発生を防止できる。また、絶縁層３が浮きを起こし、万が一発熱体４が剥離を起こした場合でも、発熱体４は絶縁層５を介してＣ型補強パイプ１０の外面に接触しているので、発熱体から発生した熱は定着ローラの芯金には伝わらないが、Ｃ型補強パイプには伝わるので、発熱体４が異常昇温することはなく、絶縁層３、５の耐熱温度を越える虞れはない。但し、この場合、発熱体４が芯金１から剥離した部分に関しては定着ローラの芯金１に発熱体４の熱が伝わらないのでローラ

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自体は所望の温度に達しないためトナーを定着することができない。従ってその現象が起こった時点でサービスパーツと交換することが必要となる。

【００１２】次に、本発明の第４の実施形態を図３(a)(b)を参照しながら説明する。この実施形態の発熱型定着ローラは、芯金１内面に貼られた絶縁層３及び発熱体４を保持するのに、Ｃ型断面になるように曲げ加工したＣ型バックアップパイプ１０を使用する構成においては図３のものと同等であるが、この実施形態では格別にバックアップパイプ１０のバネ性に着目し、バネ特性のある材料をＣ型断面になるように曲げ加工したＣ型バックアップパイプ１０を使用することにより、バックアップパイプによる発熱体４及び絶縁層３の加圧効果（膨らみ、剥離防止効果）を高めるようにしたものである。なお、第３の実施形態のバックアップパイプ１０もバネ性を有することは言うまでもない。その他の構成、動作、作用、効果は第３の実施形態について述べたものが当てはまる。なお、本発明の発熱体の支持構造は、電子写真プロセスの定着装置に用いる発熱型定着ローラのみならず、筒状の電気発熱ローラ一般に適用することができる。

【００１３】

【発明の効果】以上のように本発明によれば、芯金の内面に絶縁層を介して発熱体を形成したタイプの定着ローラにおいて、内部の発熱体の内側に更に絶縁層を介して芯金よりも熱膨張の大きな材質にて形成された補強パイプを挿入し、発熱体に通電することにより発生した熱が芯金と補強パイプの双方に伝わった時に、芯金の熱膨張率よりも補強パイプの熱膨張率の方が大きい為、内面から押し付ける力が発生し、この力により２つのパイプ形状の部材が焼きバメの原理により一体化することとなり、芯金やパイプの単体での強度が足りなくても、ローラとしての剛性を得ることが可能となる。また、芯金内面と絶縁層及び発熱体の均一な密着が得られ、芯金への均一な熱伝達が得られることにより、局所的な温度上昇や画像品質への影響を防止すると共に、温度立ち上がり時間の短縮を実現し、部品品質の向上が得られる。また、絶縁層が浮き、発熱体が剥離した場合に、発熱体の内面に更に絶縁層を介して挿入した補強パイプに発熱体からの熱を伝えることにより、発熱体が異常加熱することが防止される。また、金属製の箔肉パイプを補強パイプと使用する代わりに、絶縁性があり耐熱性のある樹脂（ＰＴＦＥなど）の箔肉パイプを補強パイプとして挿入することにより、発熱体と補強パイプの間にある絶縁層を無くしても上記と同様の機能を達成することができる。また、芯金の内面に絶縁層を介して発熱体を形成した構造をもつ電子写真に用いられる定着ローラにおいて、内部の発熱体の内側にさらに絶縁層を介して、線膨張の異なる金属を結合させた合わせ材を線膨張率が大きい金属が内側に来るようにＣ型形状に曲げた断面をもつ補強パイプを挿入した。この定着ローラの発熱体に電流を流し発熱させ熱が芯金とＣ型補強パイプの両方に伝わった時、Ｃ型補強パイプは熱膨張差によりＣが広がる方向に変形し、芯金を内面から押しつける方向に力が働く。その時発生した押しつける方向に働く力によりこのパイプが加熱時に絶縁層や発熱体を芯金に密着させることができる。

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【図面の簡単な説明】

【図１】(a) 及び(b) は本発明に係る発熱型定着ローラの構成を示す縦断面図、及びＡ－Ａ断面図等を示す図。

【図２】(a) 及び(b) は第２の実施形態に係る発熱型定着ローラの縦断面図、及びＢ－Ｂ断面図。

【図３】(a) (b) 及び(c) は第２の実施形態に係る発熱型定着ローラの縦断面図、Ｃ－Ｃ断面図及びパイプの斜視図。

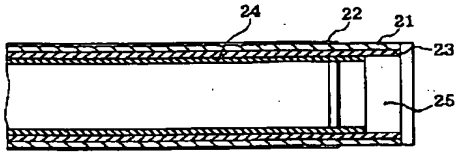
【図４】従来の定着ローラの一例の縦断面図。

【図５】(a) 及び(b) は定着ローラを構成する各構成要素の分解図及び断面図。

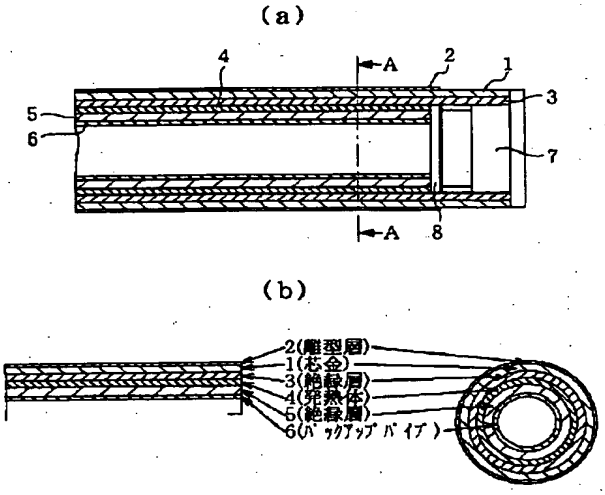
【符号の説明】

１　芯金、２　離型層、３　第１の絶縁層、４　発熱体、５　絶縁層、６　バックアップパイプ、７　電極、８　絶縁リング、９　ＰＴＦＥ製箔肉パイプ（バックアップパイプ）、１０　Ｃ型補強パイプ（バックアップパイプ）。

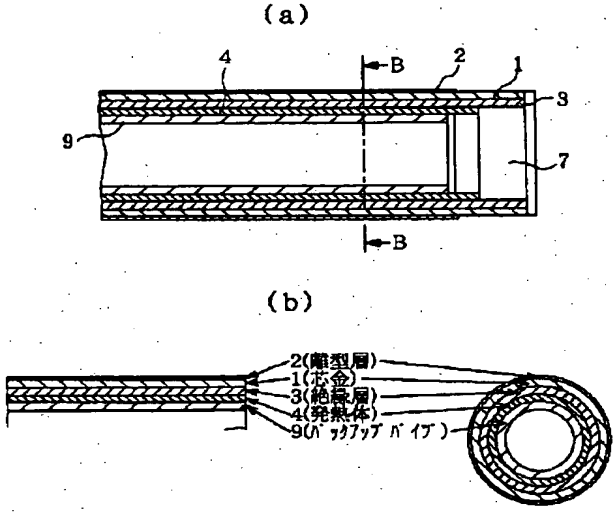
【図４】



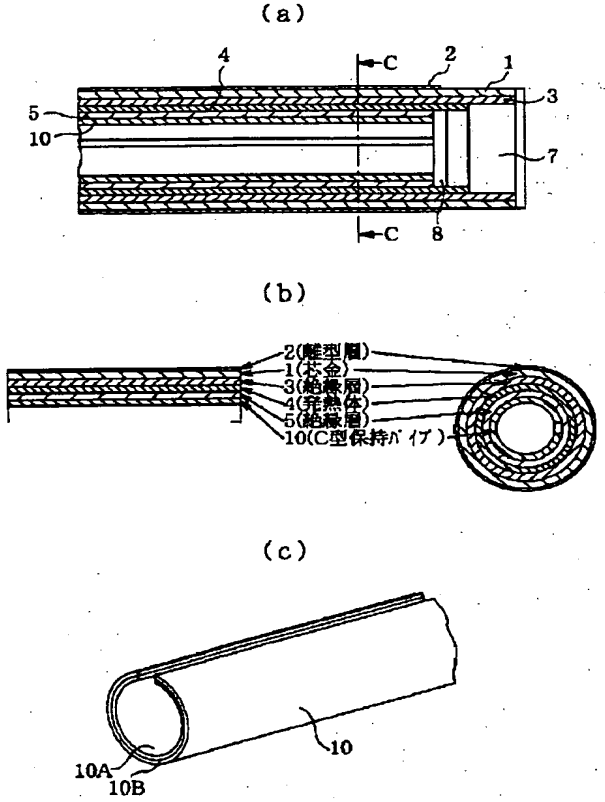
【図１】


(a)
4
A
2
1
3
5
6
7
A
8
(b)
2(離型層)
1(芯金)
3(絶縁層)
4(発熱体)
5(絶縁層)
6(バックアップパイプ)

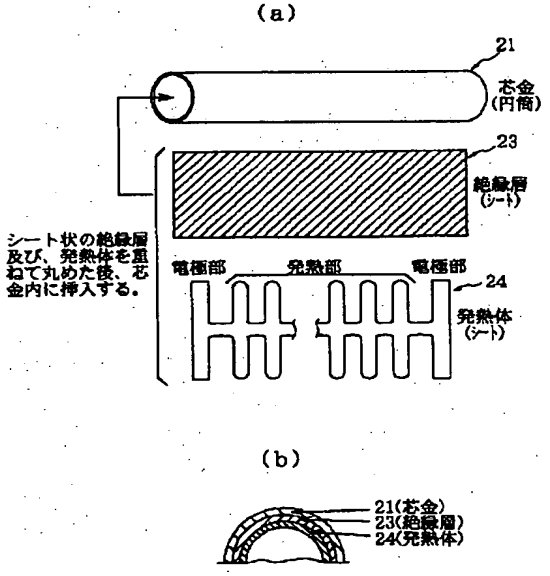
【図２】


(a)
4
B
2
1
3
9
7
B
(b)
2(離型層)
1(芯金)
3(絶縁層)
4(発熱体)
9(バックアップパイプ)

【図３】


(a)
4
C
2
1
3
5
10
7
C
8
(b)
2(離型層)
1(芯金)
3(絶縁層)
4(発熱体)
5(絶縁層)
10(C型保持パイプ)
(c)
10
10A
10B

【図５】


(a)
21
芯金
(円筒)
23
絶縁層
(シート)
シート状の絶縁層及び、発熱体を重ねて丸めた後、芯金内に挿入する。
電極部
発熱部
電極部
24
発熱体
(シート)
(b)
21(芯金)
23(絶縁層)
24(発熱体)

PATENT ABSTRACTS OF JAPAN

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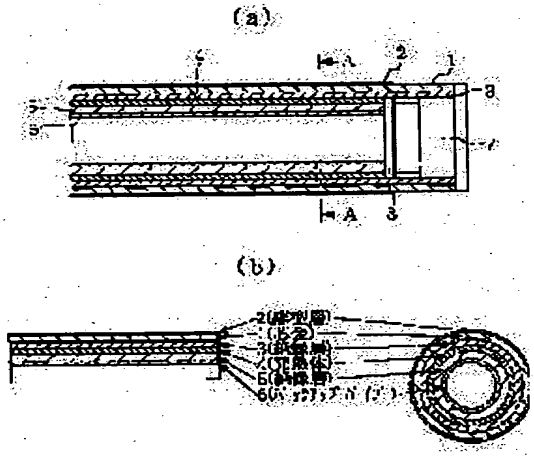
(71)Applicant : RICOH CO LTD
(72)Inventor : KASHIWANUMA HIROMASA
KENJO KOSHIN

(54) HEATING TYPE FIXING ROLLER

(57)Abstract:
PROBLEM TO BE SOLVED: To prevent the swelling phenomenon of an insulating layer and a heating element from occurring by combining a thin structure body whose heat capacity is small, to prevent the temperature of the heating element from abnormally rising and to prevent the durability of the insulating layer from being lowered by enabling heat to be transmitted to the structure body even when the heating element is peeled by any chance.
SOLUTION: This heating type fixing roller is provided with a cylindrical core bar 1, the insulating layer 3 laminated at the inside surface of the core bar 1 and the heating element 4 laminated at the inside surface of the layer 3. Then, a metallic foil pipe 6 whose thermal expansion coefficient is larger than that of the core bar is inserted in the inside surface of the heating element through another insulating layer.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] An exoergic mold fixing roller characterized by inserting a metallic foil meat pipe with a larger coefficient of thermal expansion than said rodding in an inside of said heating element through other insulating layers in an exoergic mold fixing roller equipped with an insulating layer which carried out the laminating to cylinder-like rodding and this rodding inside, and a heating element which carried out the laminating to an inside of this insulating layer.
[Claim 2] An exoergic mold fixing roller characterized by inserting a **** pipe made of resin with insulation and thermal resistance in an inside of said heating element in an exoergic mold fixing roller equipped with an insulating layer which carried out the laminating to cylinder-like rodding and this rodding inside, and a heating element which carried out the laminating to an inside of this insulating layer.
[Claim 3] An exoergic mold fixing roller characterized by carrying out insertion immobilization of the **** pipe which has C form cross-section configuration which carried out the laminating of two or more materials with which coefficien of thermal expansion differs through other insulating layers in an inside of said heating element if needed in an exoergic mold fixing roller equipped with an insulating layer which carried out the laminating to cylinder-like rodding and this rodding inside, and a heating element which carried out the laminating to an inside of this insulating layer.
[Claim 4] An exoergic mold fixing roller characterized by carrying out insertion immobilization of the **** pipe which has C form cross-section configuration which consists of a material which has spring nature in an inside of said heating element through other insulating layers if needed in an exoergic mold fixing roller equipped with an insulating layer which carried out the laminating to cylinder-like rodding at this rodding inside, and a heating element which carried out the laminating to an inside of this insulating layer.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the exoergic mold fixing roller of the type which heated rodding with the heat generated by energizing to the heating element fixed especially to the rodding inside about amelioration of the exoergic mold fixing roller used for the anchorage device of the image formation equipment using an electrophotography process.
[0002]
[Description of the Prior Art] The image formation equipment using an electrophotography process is fixing the toner image on a transfer paper with heat and a pressure by passing between the fixing rollers (heating roller) and pressurization rollers which were equipped in the anchorage device in this transfer paper, after imprinting the toner image formed on the photo conductor on a transfer paper. It replaces with the fixing roller using the conventional halogen heater with large power consumption, and development of the fixing roller of the short heating mold of build up time is performed in each company as the request of energy saving to electrophotography type image formation equipments, such as a copying machine, increases. If it is possible for most power which a copying machine consumes to be consumed by pyrexia of the fixing roller at the time of standby, and for this to make power consumption for this pyrexia there be nothing, or to make it decrease, it is because it leads to reduction of remarkable power consumption. It replaces with the conventional fixing roller which arranges a halogen heater and heated rodding inside the hollow of rodding, and the fixing roller of the exoergic mold which really formed the heating element through the insulating layer is used for the inside of rodding as a fixing roller comparatively new type.
[0003] Drawing 4 is the drawing of longitudinal section and drawing 5 (a) which show the configuration of an example of the fixing roller of the above-mentioned exoergic mold. And (b) It is the exploded view and cross section of each component. This fixing roller It has the heating element (exoergic sheet) 24 of the meandering configuration (ctenidium configuration) which carried out laminating unification inside the rodding 21, such as iron, the mold release layer 22 formed in the surface, the insulating layer 23 which carried out laminating unification at the inside of rodding 21, and an insulating layer 23. A sign 25 is an electrode for electric supply arranged to the shaft-orientations both ends of a heating element 24. As an insulating layer 23, the fixing roller of the exoergic mold of the type which stuck these on the inside of rodding 21 using heat-resistant adhesives is known, using an SUS foil (50 micrometers) as a mica, polyimide, and a heating element 24. However, the following problems have generated this type of fixing roller in that development phase. That is, if it energizes after 24-hour neglect under environment with a% [of humidity] of 90, and a temperature of 40 degrees C in spite of constituting the insulating layer 23 from a mica or polyimide, the moisture which absorbed moisture in an insulating layer 23 or adhesives will serve as a steam, it will evaporate, and the phenomenon (bulging) which swells an insulating layer will occur. Although this experiment is going too far conditional, since it is also required to consider to leave it in the condition with much moisture, such as the rainy season, to some extent, such a trial is performed. If such a bulging phenomenon develops into an insulating layer 23, the pasted-up heating element 24 will become easy to separate. When a heating element 24 separates, it does not go up to the temperature of the request which needs the temperature of rodding **** of a fixing roller to fix a toner, but stops satisfying the function of these components. Furthermore, from the portion into which the heating element 24 exfoliated, since heat does not get across to rodding, it will be heated locally, and variation occurs for the fixing engine performance. thus, when it is not necessary to assume the case of being extreme, adhesion of a rodding inside and an insulating layer is uneven and adhesion is inadequate, or when it lapses into such an adhesive agent with time If a thermo cycle is repeated, bulging of an insulating layer and peeling will occur, the fault that the heat from a heating element does not transmit to homogeneity at rodding 21 will occur, the effect on image quality will occur, accumulation will be carried out, without

the heat of a heating element getting across to rodding further, and the problem of exceeding a heat-resistant temperature of an insulating layer will arise. The one method of solving this problem is the thing to which ****** does not blister and which is pressed down from the inside so that there may be nothing. The exoergic Bando Chemical Industries roller etc. has adopted this method, inserts the silicone rubber of sponge inside a heating element, and is serving for it to expand and to press down a heating element from the inside at the time of heating. If it is in this low roller, many of heat is taken at a rubber side, and it becomes impossible however, to attain the technical problem called compaction of build up time which this roller originally makes the aim, since the heat capacity of the silicone rubber of sponge is large.

[0004]

[Problem(s) to be Solved by the Invention] When this invention is made in view of the above and heat capacity combines the small structure with thin meat, while preventing bulging **** of an insulating layer and a heating element even when a heating element separates, it is made for heat to get across to the direction of the structure, and it prevents a heating element carrying out an abnormality temperature up, and aims at enabling it to prevent that the endurance of an insulating layer falls.

[0005]

[Means for Solving the Problem] In order to attain the above-mentioned technical problem, invention of claim 1 is characterized by inserting a metallic foil meat pipe with a larger coefficient of thermal expansion than said rodding in an inside of said heating element through other insulating layers in an exoergic mold fixing roller equipped with an insulating layer which carried out the laminating to cylinder-like rodding and this rodding inside, and a heating element which carried out the laminating to an inside of this insulating layer. Invention of claim 2 is characterized by inserting a **** pipe made of resin with insulation and thermal resistance in an inside of said heating element in an exoergic mold fixing roller equipped with an insulating layer which carried out the laminating to cylinder-like rodding and this rodding inside, and a heating element which carried out the laminating to an inside of this insulating layer. Invention of claim 3 is characterized by carrying out insertion immobilization of the **** pipe which has C form cross-section configuration which carried out the laminating of two or more materials with which coefficient of thermal expansion differs through other insulating layers in an inside of said heating element if needed in an exoergic mold fixing roller equipped with an insulating layer which carried out the laminating to cylinder-like rodding and this rodding inside, and a heating element which carried out the laminating to an inside of this insulating layer. Invention of claim 4 is characterized by carrying out insertion immobilization of the **** pipe which has C form cross-section configuration which consists of a material which has spring nature in an inside of said heating element through other insulating layers if needed in an exoergic mold fixing roller equipped with an insulating layer which carried out the laminating to cylinder-like rodding at this rodding inside, and a heating element which carried out the laminating to an inside of this insulating layer.

[0006]

[Embodiment of the Invention] Hereafter, the gestalt of operation shown in the drawing explains the exoergic mold fixing roller concerning this invention to details. Drawing 1 (a) And (b) It is drawing showing the drawing of longitudinal section showing the configuration of the exoergic mold fixing roller concerning this invention, an A-A cross section, etc. It has rigidity, and its coefficient of thermal expansion is small, and in order to prevent rust, it needs to perform [the rodding 1 of a fixing roller has desirable materials, such as cheap iron, and] parka processing. Moreover, the mold release layer 2 of a Teflon system (PFA and PTFE) is formed in the drum section external surface of this rodding 1. Laminating formation of the 1st insulating layer 3 is carried out at the inside of rodding 1, and the quality of the material uses the object which made both the mica in consideration of insulation and thermal resistance, and both [heat-resistant / a heat-resistant monolayer or] rival, or the object which backed the glass fiber. It may paste up, or this insulating layer 3 and a rodding inside may not be carried out, or may be any. Furthermore, the heating element 4 has pasted the medial surface of an insulating layer 3 with heat-resistant adhesives. A heating element 4 is cut into the pattern of arbitration so that the resistance of a request of metallic foils (about 50 micrometers in thickness), such as SUS, by methods, such as etching and laser beam machining, may be acquired (refer to drawing 5 (a)). The adhesives which have the thermal resistance of a silicone system or an imide system as adhesives used for adhesion of a heating element 4 are desirable. The 2nd insulating layer 5 is further formed in the medial surface of a heating element 4. The same quality of the material as what was used for the 1st insulating layer 3 is sufficient as the quality of the material. This insulating layer 5 is pasted up on the inside of a heating element 4 with adhesives with the same thermal resistance as the above.

[0007] With this operation gestalt, the pipe 6 for one more backup is inserted into the exoergic mold fixing roller of such a configuration. As for the quality of the material of this backup pipe (**** pipe) 6, it is desirable to process and use a metal with a bigger coefficient of thermal expansion than rodding of a fixing roller for a thin cylinder like ****

(thickness of 0.5mm or less) which consists for example, of an aluminum system material. Between the backup pipe 6 and an electrode 7, an insulating ring 8 intervenes so that the overall length may be short and may not contact an electrode 7 rather than the rodding 1 of a fixing roller, since the electrode 7 for [in the backup pipe 6] electric supply to the both ends is inserted. It is desirable to manufacture this insulating ring 8 by resin with thermal resistance, and PTFE etc. hits it. Thus, with this operation gestalt, the metal **** pipe 6 which consists of the large quality of the materials (aluminum system material etc.) of thermal expansion rather than rodding 1 is used as a backup pipe 6 for holding the insulating layer 3 and heating element 4 which were stuck one by one into the rodding 1 which consists of an iron system material. If electric power is supplied to the fixing roller of this operation gestalt, a heating element 4 will generate heat and heat will get across to rodding 1 and the inside backup pipe 6. The backup pipe 6 is extended in the outer-diameter direction by thermal expansion, and pushes an insulating layer 3 and a heating element 4 against the inside of rodding 1. For this reason, an insulating layer 3, the swelling of a heating element 4, and exfoliation are prevented, accumulation is carried out without the effect on the image quality by the heat from a heating element not transmitting to homogeneity at rodding 1 and the heat of a heating element getting across to rodding, and the fault that a parts replacement is needed exceeding a heat-resistant temperature of an insulating layer can be prevented.

[0008] Next, actuation of the exoergic mold fixing roller concerning the operation gestalt of drawing 1 and a principle are further explained to details. First, when it energizes and generates heat to the heating element 4 of the exoergic mold fixing roller shown in drawing 1 , of course, as for rodding 1, the heat will get across also to the backup pipe 6. From rodding 1, since coefficient of thermal expansion is large, the backup pipe 6 acts in the direction in which the backup pipe 6 forces rodding 1 in the outer-diameter direction from an inside. The members 1 and 6 of two pipe configurations will burn by this, and it will unify by the principle of BAME, and even if the reinforcement in the simple substance of rodding 1 or the backup pipe 6 is insufficient, it becomes possible to acquire the rigidity as the whole fixing roller. Moreover, a big difference is not produced when it sees as build up time of a fixing roller, since the heat capacity of the whole fixing roller does not become so large even if it measures it with a fixing roller in case there is no backup pipe 6. Moreover, since the force works in the direction in which the backup pipe 6 presses the inside of the rodding 1 of a fixing roller in the outer-diameter direction at the time of heating by energization, the fault to which a heating element 4 carries out an abnormality temperature up, and the endurance of an insulating layer 3 falls can be prevented by an insulating layer's 3 floating, separating from a rodding inside, and removing a heating element 4. Moreover, since it gets across to the backup pipe 6 and escapes while the heat generated with the heating element 4 does not get across to the rodding 1 of a fixing roller, since the heating element 4 touches the backup pipe 6 through the 2nd insulating layer 5 even when an insulating layer 3 should float and a heating element 4 should separate, a heating element 4 does not carry out an abnormality temperature up, and the endurance of an insulating layer 3 or an insulating layer 5 does not fall. However, since the heat of a heating element 4 does not get across to the rodding 1 of a fixing roller about the portion into which the heating element 4 exfoliated from rodding 1 in this case, since the roller itself does not reach a desired temperature, it cannot be established in a toner. Therefore, when the phenomenon happens, it is necessary to exchange for service parts.

[0009] Next, drawing 2 (a) And (b) A drawing of longitudinal section, a B-B cross section, etc. of the exoergic mold fixing roller concerning the 2nd operation gestalt are shown, and since the configuration to the rodding 1 of a fixing roller - a heating element 4 and the configuration of an electrode 7 are the same as the case of drawing 1 , explanation of a configuration of having overlapped is omitted. That this operation gestalt differs from the operation gestalt of drawing 1 is the point of having attached the **** pipe 9 made from PTFE as a backup pipe with insulation and thermal resistance in the inside of the direct heating element 4, without using the 2nd insulating layer 5. Since coefficient of thermal expansion is larger than the metallic material (iron and aluminum) which constitutes rodding 1, PTFE which constitutes a backup pipe becomes possible [attaining the same holding-down function as the case of drawing 1 with the structure simplified more]. Although rodding is an iron system material and PTFE with a larger thermal expansion than iron was used for the backup pipe 9 in this example, PTFE is an example, and as long as it is the insulation and heat-resisting material which fulfill the above-mentioned conditions, it may use anything. Thus, since the backup pipe 9 which consists of an insulating material with a larger thermal expansion than the material which constitutes rodding 1 from this operation gestalt in order to hold the insulating layer 3 and heating element 4 which were stuck into rodding 1 and to prevent bulging and exfoliation was used, the 2nd insulating layer 5 for insulating the BAKKUAPU pipe 9 with heating element 4, and a backup pipe and the insulating ring 8 by which it is placed between electric supply inter-electrode become unnecessary. Since a heating element 4 generates heat and heat makes rodding 1 and the inside backup pipe 6 extend propagation and the backup pipe 6 in the outer-diameter direction by thermal expansion when electric power is supplied to the fixing roller of this operation gestalt, an insulating layer and a heating element are pushed against a rodding inside. For this reason, an insulating layer 3, the swelling of a heating element 4, and

exfoliation are prevented, accumulation can be carried out without the effect on the image quality by the heat from a heating element not transmitting to homogeneity at rodding 1 and the heat of a heating element getting across to rodding, and the fault of resulting in a parts replacement exceeding a heat-resistant temperature of an insulating layer can be prevented.

[0010] Next, drawing 3 (a) And (b) It is a drawing of longitudinal section, a C-C cross section, etc. of the exoergic mold fixing roller concerning the 3rd operation gestalt, and is (c). It is the perspective diagram of an example of a backup pipe. In addition, the configuration to the rodding 1 of a fixing roller - an insulating layer 5 and the configuration of an electrode 7 and an insulating ring 8 are the same as the case of drawing 1 . The configuration of the portion of a backup pipe differs from the case where this operation gestalt is drawing 1 . The point using C mold reinforcement pipe 10 which carried out bending of the doubling material (dissimilar metal superposition plate used for the compound alloy board of the shape of a layer combined completely, for example, bimetal etc.) as a backup pipe instead of the backup pipe 6 of the shape of a cylinder which continued with the operation gestalt of drawing 3 so that it might become C mold cross section is characteristic. C mold reinforcement pipe 10 using doubling material has two-layer structure which stuck the metals 10A and 10B with which coefficient of linear expansion differs. Lamination association of two sorts of metals is carried out so that metal 10A with a big coefficient of linear expansion may be carried out inside C configuration and the laminating unification of the metal 10B with a coefficient of linear expansion smaller than it may be carried out outside. As the quality of the material of these doubling material, the alloy of the low expansion coefficient located outside can illustrate an austenite nickel-Cr-Fe alloy, a nickel-Mn-Fe alloy, etc. as an alloy of the high expansion coefficient located in the insides, such as Invar (nickel-Fe). Thus, with the 3rd operation gestalt, C mold backup pipe 10 which carried out bending of the doubling material so that it might become in C mold cross section (configuration where some cylinder objects were continued and cut for the shaft-orientations overall length) although the insulating layer 3 and heating element 4 which were stuck into rodding 1 are held is used. C mold backup pipe 10 has two-layer structure which stuck the metal with which coefficient of linear expansion differs, and is extended in the outer-diameter direction with heating. Furthermore, since the configuration of a barrel itself is a C configuration, after contracting the path at the time of insertion of a backup pipe and carrying out an insertion point arrangement easily, you can make it extended by canceling the pressurization to the diameter reduction direction, and it can attach in the interior of a roller. Therefore, what has a larger path than the backup pipe used with said each operation gestalt can be used. In addition, since the backup pipe 10 is metal, the insulating layer 5 for insulating the backup pipe 10 with a heating element 4 like the 1st operation gestalt and the insulating ring 8 for insulating between the electric supply electrodes 7 with a backup pipe are inserted.

[0011] Subsequently, the actuation and a principle are explained about the 3rd operation gestalt shown in drawing 3 . That is, when it energizes to the heating element 4 of the exoergic mold fixing roller equipped with the configuration of drawing 3 and it is made to generate heat, the heat will get across also to C mold reinforcement pipe 10 as well as rodding 1. C mold reinforcement pipe is the doubling material which combined two metals (foil) 10A and 10B with a linear expansion difference. In order that the force may work in the direction which makes this C mold extend in the outer-diameter direction since the coefficient of linear expansion of metal 10A which is furthermore inside C mold configuration is larger than the coefficient of linear expansion of metal 10B which is outside, the force will act in the direction pushed outside from an inside at the rodding 1 of a fixing roller like the case where it is drawing 1 . Therefore an insulating layer 3 raises a float from a rodding inside, and exfoliates, and a heating element can prevent generating o the situation which carries out an abnormality temperature up and exceeds a heat-resistant temperature of an insulating layer 3 by removing a heating element 4. Moreover, although the heat with which the insulating layer 3 generated the float from the heating element since the heating element 4 touched the external surface of C mold reinforcement pipe 1(through the insulating layer 5 even when a heating element 4 should have caused exfoliation, a lifting and does not get across to rodding of a fixing roller, since it gets across to C mold reinforcement pipe, there is no possibility of a heating element 4 not carrying out an abnormality temperature up, and exceeding a heat-resistant temperature of insulating layers 3 and 5. However, since the heat of a heating element 4 does not get across to the rodding 1 of a fixing roller about the portion into which the heating element 4 exfoliated from rodding 1 in this case, since the roller itself does not reach a desired temperature, it cannot be established in a toner. Therefore, when the phenomenon happens, it is necessary to exchange for service parts.

[0012] Next, it is drawing 3 (a) about the 4th operation gestalt of this invention. (b) It explains referring to. Although th exoergic mold fixing roller of this operation gestalt is equivalent to the thing of drawing 3 in the configuration which uses C mold backup pipe 10 which carried out bending so that it may become in C mold cross section, although the insulating layer 3 and heating element 4 which were stuck on rodding 1 inside are held By using C mold backup pipe 1(which carried out bending of the material which has a spring property exceptionally with this operation gestalt paying

attention to the spring nature of the backup pipe 10 so that it might become C mold cross section The pressure effect (swelling the exfoliation prevention effect) of the heating element 4 by the backup pipe and an insulating layer 3 is heightened. In addition, it cannot be overemphasized that the backup pipe 10 of the 3rd operation gestalt also has spring nature. What other configurations, actuation, the operation, and the effect stated the 3rd operation gestalt to is applied. In addition, the supporting structure of the heating element of this invention is applicable not only to the exoergic mold fixing roller used for the anchorage device of an electrophotography process but a tubed electric general exoergic roller.
[0013]
[Effect of the Invention] In the fixing roller of the type which formed the heating element in the inside of rodding through the insulating layer as mentioned above according to this invention The reinforcement pipe formed with the quality of the material with a bigger thermal expansion than rodding is further inserted through an insulating layer inside an internal heating element. When the heat generated by energizing to a heating element gets across to the both sides of rodding and a reinforcement pipe Since the coefficient of thermal expansion of a reinforcement pipe is larger than the coefficient of thermal expansion of rodding, the force forced from an inside occurs. The member of two pipe configurations will burn according to this force, and it will unify by the principle of BAME, and even if the reinforcement in the simple substance of rodding or a pipe is insufficient, it becomes possible to acquire the rigidity as a roller. Moreover, while preventing the effect on a local temperature rise or image quality by obtaining uniform adhesion of a rodding inside, an insulating layer, and a heating element, and obtaining uniform heat transfer to rodding, compaction of temperature build up time is realized and improvement in components quality is obtained. Moreover, when an insulating layer floats and a heating element exfoliates, it is prevented by telling the heat from a heating element to the reinforcement pipe further inserted in the inside of a heating element through the insulating layer that a heating element carries out abnormality heating. Moreover, instead of using a metal **** pipe with a reinforcement pipe, by inserting the **** pipe of the resin (PTFE etc.) which is insulating and has thermal resistance as a reinforcement pipe, even if it loses the insulating layer between a heating element and a reinforcement pipe, the same function as the above can be attained. Moreover, in the fixing roller used for the electrophotography which has the structure which formed the heating element through the insulating layer in the inside of rodding, the reinforcement pipe with the cross section which bent the doubling material which combined the metal with which linear expansion differs through an insulating layer further inside an internal heating element in C mold configuration so that a metal with a large coefficient of linear expansion might come inside was inserted. When the heating element of this fixing roller is made to carry out sink pyrexia of the current and heat gets across to it at both rodding and C mold reinforcement pipe, C mold reinforcement pipe deforms in the direction in which C spreads by the differential thermal expansion, and the force works in the direction which forces rodding from an inside. This pipe can stick an insulating layer and a heating element to rodding according to the force committed in the direction which was then generated, and to force at the time of heating.

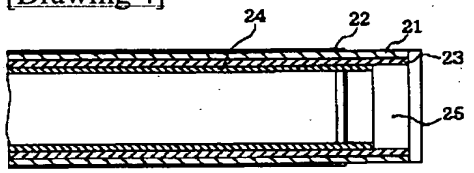
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

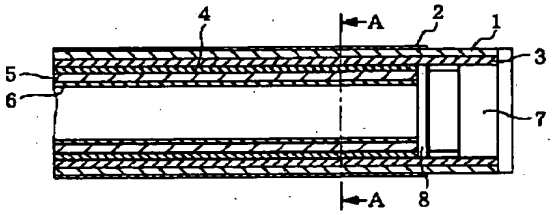
DRAWINGS

[Drawing 4]

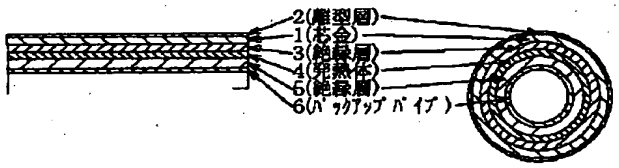


[Drawing 1]

(a)

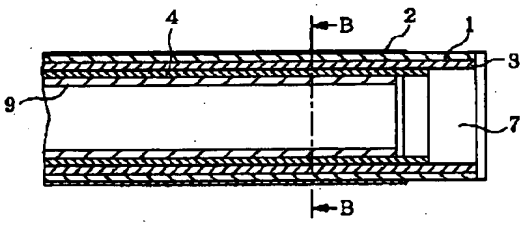


(b)



[Drawing 2]

(a)



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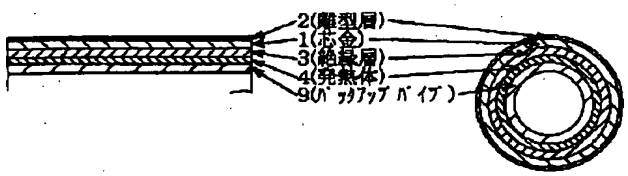
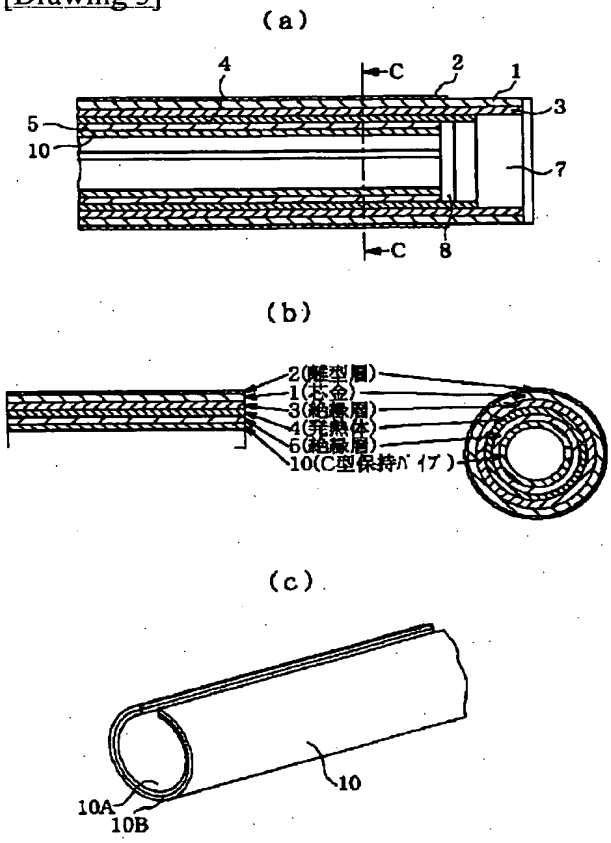
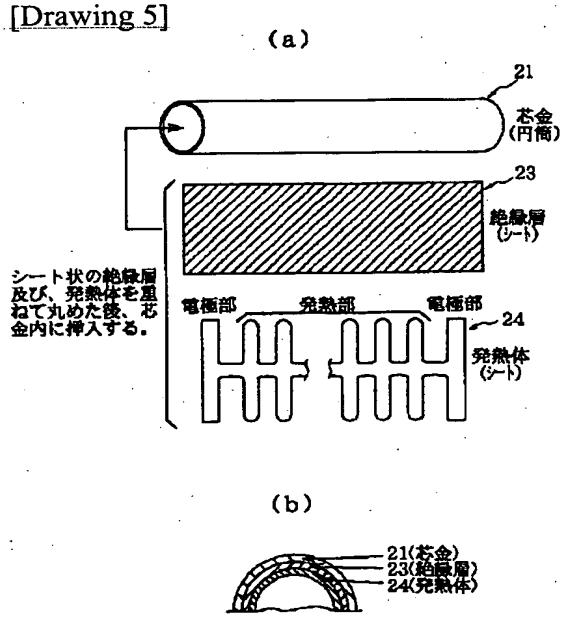


[Drawing 3]



[Drawing 5]



[Translation done.]